Diets supplemented with L-methionine provide huge saving in feed costs

Methionine (Met) is the first limiting amino acid in broilers and, together with cysteine (Cys), is a crucial amino acid that needs to be met correctly.

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Met is supplemented in feed in powder form i.e. DL-Methionine and L-Methionine, or in liquid form DL-Hydroxy analogue (DL-MHA). Hydroxy analogue is also available in powder form as a calcium salt.

Bioavailability of methionine

There is huge discrepancy in the literature about the bioavailability of methionine sources. Part of the discrepancy is related to the fact that the sulphur amino acid (SAA) requirements of broilers are not well defined and it is confounded with the bioavailability of the methionine source used to define the SAA requirement.

The requirements for SAAs define the dynamic range of response when adding DL or L isomer form of methionine or their liquid hydroxy analogue to a SAA deficient diet. Thus it is important to use a correct SAA level before designing a requirement or bioavailability trial.

L-Methionine has been produced by a fermentation-based process by CJ Bio on a commercial scale since 2014.

In the absence of L-Methionine, the SAA requirement of broilers was defined in DL-Methionine supplemented diets.

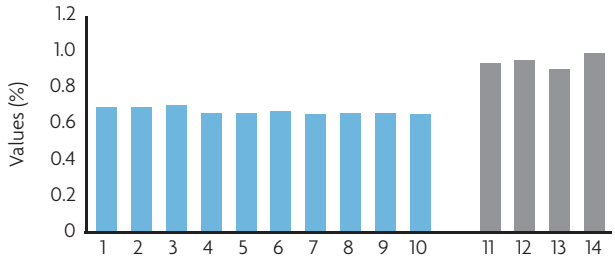
In order to improve the understanding of the SAA requirements in broilers, we have designed trials to investigate the optimal SAA requirement of broilers in the starter, grower and finisher phases in diets supplemented with L-Methionine.

Basal diets containing 0.60%, 0.55% and 0.50% SID Met plus Cys (50% Met and 50% Cys; deficient in SAA) were created for starter, grower and finisher phases.

1,890 male Ross 308 broilers were randomly allocated to dietary groups (six replicates per treatment and 15 animals per replicate) and the Ross 308 recommended table values were used as a guideline to define the dynamic ranges of SAA response. L-Methionine was added to the basal diets to reach a stepwise increase in SID Met plus Cys (for example: 0.65, 0.70, 0.75, 0.85, 0.95 and 1.05% in starter phase).

The body weight (BW), daily weight gain (DWG), daily feed intake (DFI) and feed conversion ratio (FCR) were measured. In order to define the SAA requirements of each growth phase, fresh birds were inserted into the experimental pens from a pool group.

Additionally, feed samples of the test diets were analysed to determine major nutrients including amino acids which appeared to be at or close to formulated values.



1. Body weight
2. Daily weight gain
3. Daily feed intake
4. Feed conversion ratio
5. Live slaughter weight
6. Carcase weight
7. Breast weight
8. Leg weight
9. Breast yield live
10. Breast yield carcase
11. Ross 308 VEG
12. Ross 308
13. NRC
14. Brazilian table

Fig. 1. Comparison of optimal SID Met plus Cys values (%) in starter phase with table values. Breast weight live means breast weight as a percentage of live weight and breast yield carcase means breast weight as a percentage of carcase yield. Ross 308 VEG is the recommendations of Aviagen for 100% vegetarian diets.

Table 1. Optimal digestible methionine plus cysteine in starter, grower and finisher phases of Ross 308 broilers.

Parameters	Optimal digestible methionine and cysteine level (%)		
	Starter	Grower	Finisher
Body weight	0.69	0.66	0.56
Daily weight gain	0.69	0.63	0.65
Daily feed intake	0.70	ND	ND
Feed conversion ratio	ND	0.62	0.62
Carcase weight	0.66	0.61	ND
Breast weight	0.66	0.69	0.65
Leg weight	0.65	0.60	ND
Average	0.67	0.64	0.62

ND: Means that model fit was poor for both models

Optimal requirements

The optimal Met plus Cys requirements were determined using linear broken line and exponential asymptomatic models. Model fit was evaluated based on the R^2 of individual observations and graphical interpretation. The linear broken line model showed the best fit which was demonstrated with a higher R^2 value. The optimal SID Met plus Cys levels for performance parameters are summarised in Table 1.

Optimal levels of SID Met plus Cys for the best body weight and weight gain were found to be around 0.70, 0.65 and 0.60% for the starter, grower and finisher phases, respectively.

Results of SID Met plus Cys requirements were also compared with the other table values (Fig. 1).

On average, table values (based on DL-Methionine) are recommending 0.94% SID Met plus Cys for the starter phase. The current trial (based on L-Methionine) recommends 0.67% SID Met plus Cys, which is 0.27 unit lower than table values.

This new value for the starter phase is 20% lower compared to the recommendations of NRC and Ross 308 (0.90% and 0.94% SID Met plus Cys, respectively).

These recommendations were defined in diets based on DL-Methionine. Performance of broilers based on Ross 308 at day 10 of age is 321g BW.

In the current study, chicken requirements for the maximum performance needed 20% lower SID Met plus Cys, while performing similarly (326g BW). Fig. 2 shows result of a comparison between SID Met plus Cys requirements of the current trial and the other table values. On average, table values (based on DL-Methionine) are recommending 0.84% SID Met plus

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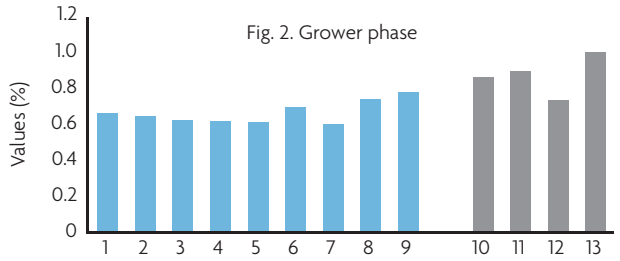

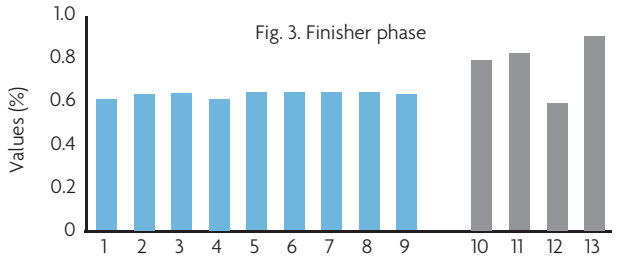

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Fig. 2. Comparison of optimal SID Met plus Cys values (%) in grower phase with table values. Fig. 3. Comparison of optimal SID Met plus Cys values (%) in finisher phase with table values. Breast weight live means breast weight as a percentage of live weight and breast yield carcase means breast weight as a percentage of carcase yield. Ross 308 VEG is the recommendations of Aviagen for 100% vegetarian diets.

Continued from page 11
Cys for the grower phase. The current trial (based on L-Methionine) recommends 0.66% SID Met plus Cys, which is 0.19 unit lower than table values.

These new requirement values for the grower phase are more than 20% lower than the recommendations of NRC and Ross 308 (0.90% and 0.87% SID Met plus Cys, respectively), which are defined based on DL-Met.

The suggested body weight of broilers for Ross 308 at day 23 of age is 1,142g.

In the present study, the comparative performance of the broilers (1,191g BW) at day 23 of age was achieved with 20% lower Met plus Cys as compared to the standard recommendation.

A similar comparison was done in the finisher phase (Fig. 3). Table values (based on DL-Methionine) recommends 0.78% SID Met plus Cys.

The current trial (based on L-Methionine) showed that SID Met plus Cys of broilers in the finisher phase is around 0.64%, which is 0.14 unit lower than table values.

Thus, on average L-Methionine can create 0.27, 0.19, and 0.14 unit reduction in SID Met plus Cys in the starter, grower and finisher phases.

Interestingly, the highest saving (0.27 unit) happens in the starter phase which might be attributed to the lack of D-methionine converting enzyme activity in the young chicks.

Conclusion

In conclusion, L-Methionine can create up to 20% reduction in SID Met plus Cys recommendations, which will create a huge saving in feed costs.

This is one of the first reports presenting a practical approach to the animal industry in order to save on feed costs based on the advantages of L-Methionine over DL-Methionine. ■